Chapter 6

Prescribing Solutions: Landscape-Based Land-Use Plans

6.1 Introduction

This chapter presents approaches to developing plans and policies that incorporate the information collected during Step 1 of the four-step framework—the analysis of the landscape and its wetlands—as described in Chapter 5. Developing plans and policies is part of Step 2 (Prescribing Solutions) in the framework of a wetland management program (Figure 6-1).

Plans and policies are enhanced by information generated in Step 1, which involves analyzing the role that wetlands play in landscape processes. Landscape processes both maintain and interact with wetlands and the functions they perform. Landscape processes can include physical processes such as those that maintain hydrology and the physical stability of shorelines; chemical processes such as those that maintain or degrade water quality; and ecological processes such as those that maintain habitats and species.

The results of these landscape analyses are used in Step 2 to identify solutions that reduce the risk of human activities that degrade or eliminate wetlands and landscape processes.

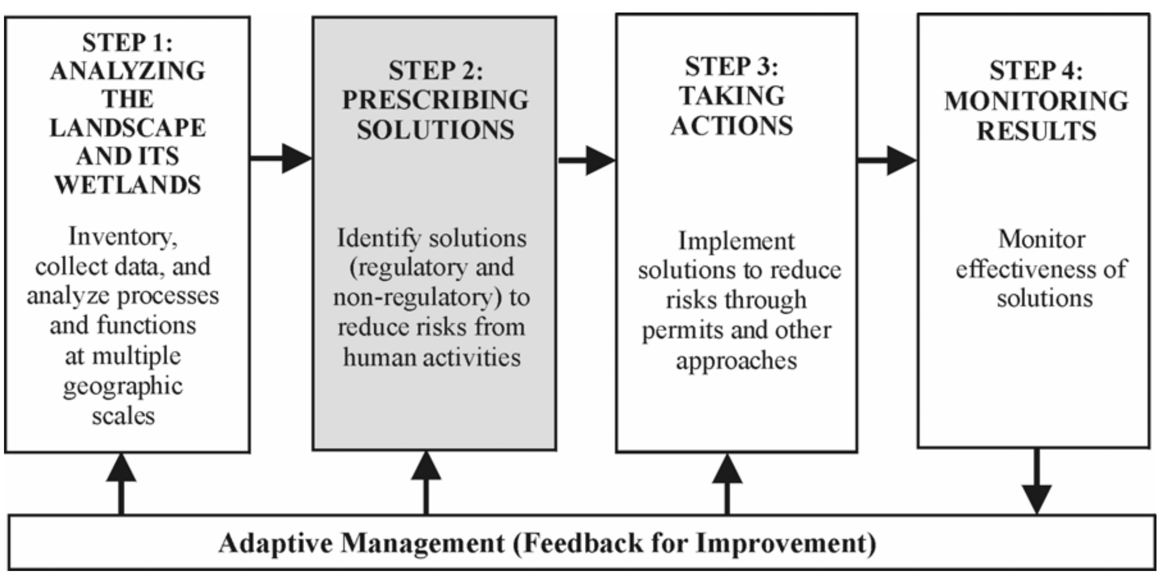

Figure 6-1. Developing plans and policies fits into Step 2 within the four-step framework recommended for protecting and managing wetlands (shaded box).

This chapter begins with a brief overview of planning and the Washington State Growth Management Act (GMA) (Section 6.2). It then describes the importance of using landscape analysis and approaches (at the appropriate scales) when initiating and completing planning processes (Section 6.3). Next, Smart Growth is introduced (Section 6.4); the concepts of which form the foundation for two complementary planning applications called Green Infrastructure and Alternative Futures which are described in some detail. These approaches have been used as reliable frameworks for the inclusion of landscape analysis and perspectives within both local (such as subarea plans) and comprehensive planning processes (described in Chapter 7). The chapter concludes (Section 6.5) with a discussion of the fiscal benefits of maintaining landscape processes by protecting critical areas such as wetlands, floodplains, streams and riparian areas, nearshore areas, etc.

6.2 Overview of Planning and the GMA

Land-use planning, in the context of resource management, is the formalized process by which jurisdictions identify what can or cannot occur on lands within their regulatory authority. In Washington State, land-use planning is implemented at a local (county or city) level of government and is directed by the Growth Management Act (GMA), with state agency technical assistance and oversight.

In 1990 the Washington State Legislature passed the GMA (RCW 36.70A) to guide local jurisdictions in their land-use planning efforts. The GMA dictates that counties and cities with certain characteristics must fully plan for future growth (RCW 36.70A.040). (Chapter 2 of this volume provides an overview of the GMA and a review of Hearings Board and court cases relating to the GMA, critical areas, and best available science.)

The GMA identifies goals to be used by local governments to “guide” the development of comprehensive plans. A full range of actions is included, such as concentrating development to limit urban sprawl; coordinating infrastructure for transportation; avoiding incompatible uses while maintaining the extraction of natural resources from forests and mines and agricultural production on designated lands of long-term commercial significance; as well as protecting the environment and the quality of life in the state. Cities and counties planning under the GMA have responded to these mandates by developing or updating their comprehensive plans and the codes and ordinances that implement the plans.

The planning process should begin with an understanding of existing natural resources (e.g., wetlands, floodplains, riparian areas, etc.) and the functions they provide, as well as the broader landscape processes with which they interact. Once these have been identified, they should be protected through comprehensive plans, other local plans, and the regulations and management practices that implement the plans.

Planning concepts and approaches described in this chapter (Smart Growth, Green Infrastructure, and Alternative Futures) use landscape-scale information to evaluate possible scenarios for future use and management of the land. They incorporate alternative approaches for meeting future community needs while protecting ecosystems. The general objective of these approaches is to help identify options that both minimize environmental impacts and use the functions (services) provided by the ecosystems that exist within a healthy landscape. Wetlands, for example, will retain and slow floodwaters and recharge both stream flow and aquifers – environmental functions which engineering cannot easily or inexpensively replace. Good planning is therefore vital for protecting ecosystems, including critical areas and the functions they provide, as well as saving money for the community in the long run.

The planning approaches described below can be used as a basis for revising comprehensive plans or subarea plans, developing watershed protection and restoration plans, and supporting other planning and management efforts. They also provide a pragmatic approach for actively engaging the public by incorporating their direct input in the evaluation phase and by participating in making decisions about the future of their communities and surrounding landscapes.

Factors to consider when making land-use decisions affecting the future

In the paper *Ecological Principles and Guidelines for Managing the Use of Land* by V.H. Dale et al. (2000), scientists from around the country collaborated to identify factors to consider when making land-use decisions. These factors include the following:

1. Examine the impacts of choices in a regional (or landscape) context

2. Plan for long-term change and unexpected events

3. Preserve rare landscape elements, critical habitats, and associated species

4. Avoid land uses that deplete natural resources over a broad area

5. Retain large contiguous or connected areas that contain critical habitats

6. Minimize the introduction and spread of non-native species

7. Avoid or compensate for the effects of development on ecological processes

8. Implement land use and land management practices that are compatible with the natural potential of the area

The paper provides guidance for applying each of these factors to the planning process. They note that the mobility of human activities is more flexible (within limits) than the mobility of important landscape processes and ecosystem functions. Therefore, ecological constraints (the need to manage landscape processes for the long term) can be used as the primary consideration in land-use planning. The planning sequence they suggest is to first plan for maintaining water and biodiversity; then for cultivation, grazing, and the harvesting of wood products; then for managing sewage and other wastes; and finally for the placement of homes and industry. (The goals in the list above are also listed in Chapter 1 and should be considered throughout the four-step framework for protecting and managing wetlands and other critical areas.)

6.3 The Importance of Incorporating a Landscape Perspective in Planning

Land-use planning has traditionally focused on human actions implemented through management decisions at the level of the individual site or parcel. It has done so without always considering what is needed to protect environmental processes and wetlands at the landscape level (Dale et al. 2000). The synthesis of the science in Volume 1 indicates that the lack of incorporating information about the landscape in decisions made about land use, including those involving wetlands and their functions, is a major deficiency. For example, Volume 1 concludes that cumulative impacts lead to the degradation of wetlands and other natural resources. This results in the loss of landscape and watershed processes over time. A cumulative impact is "*…the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions...Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time*" (Council on Environmental Quality 1997 http://ceq.eh.doe.gov/nepa/regs/ceq/1508.htm#1508).

Volume 1 goes on to state that regulatory programs that are based on a case-by-case approach and a lack of consistency between jurisdictions are two of the causes of cumulative impacts. Studies cited in Volume 1 found that decision-making that only considers individual projects without taking into account the larger landscape does not address cumulative effects (Johnston et al. 1990, U.S. Environmental Protection Agency 1999, Dale et al. 2000). This is especially significant for landscape processes that occur across jurisdictional boundaries (i.e., processes within the contributing landscape as depicted in Figure 4-2 in Chapter 4 of this volume).

One of the solutions for reducing cumulative impacts in the future, therefore, is developing plans and policies that incorporate information on larger landscape changes on these ecosystems and their respective landscape processes. Through analyses using data generated at this scale, local governments gain an understanding of where processes and functions occur, the interactions between ecosystems and the surrounding landscape, and how land uses may affect them.

With this knowledge comes the ability to minimize cumulative impacts to processes, functions, and resources by developing plans, policies, and setting clear management objectives that affect growth patterns. These can dictate which areas will be most fully protected and which may be degraded or remain in a degraded condition.

Plans, policies, and management objectives can in turn initiate protection programs that go beyond case-by-case decision-making by considering the larger landscape. For example, comprehensive planning based on landscape information can serve as the platform for critical areas ordinances, clearing and grading ordinances, zoning designations, shoreline master programs, protection measures through the Endangered Species Act, as well as non-regulatory restoration and preservation programs.

Local governments, therefore, benefit from having an understanding of key landscape processes and the functions that networks of critical areas provide. Landscape information can identify the capacity of natural resources like wetlands to provide important services to communities such as maintaining water quality, reducing flooding, etc. Local governments gain a clearer understanding of where these processes and functions occur in order to steer development to more appropriate areas and thereby reduce impacts to the processes and functions.

Plans and regulations based on scientific information may result in a more efficient permitting process by reducing the need to complete complex environmental review and detailed studies at the permitting level. They also can facilitate cooperation between jurisdictions, thereby further reducing cumulative impacts.

Minimizing the cumulative impacts of land use through landscape-based plans, policies, and implementing regulations can prevent costly problems by maintaining landscape processes and wetland functions over time. The result is a fiscally responsible approach to sustaining development.

6.4 Smart Growth

Smart Growth is a relatively new, conceptual framework for improving land-use planning and the management of growth in communities. It provides core defining principles intended to guide the development of land-use plans and policies as well as implementing regulations and practices. Its purpose is to minimize the negative effects of sprawl development on both local communities and the environment. Smart Growth integrates better economic, social, financial, and environmental outcomes for a community. It represents planned actions taken with all the community's benefits in mind both in the near term and well into the future.

Applying the principles of Smart Growth has been found to be fiscally beneficial by recognizing that certain patterns of growth and decline significantly hurt communities by undermining both their economies and the environment (Muro and Puentes 2004). In their paper *Investing in a Better Future: A Review of the Fiscal and Competitive Advantages of Smarter Growth Development Patterns,* Muro and Puentes (2004) found that Smart Growth can reduce public costs of installing new infrastructure and delivering new services, improve a region's economic performance, and bring economic gains to suburbs as well as cities. (See Appendix 6-A for additional references and web pages about Smart Growth.)

The National Governors' Association promotes the use of Smart Growth land-use planning and practices as beneficial for local communities. They recognize that it is not necessarily growth that is the problem but the patterns of sprawl-induced growth which are harmful (see the National Governors' Association web site www.nga.org).

Smart Growth focuses on growth that protects open space, revitalizes neighborhoods, and makes housing more affordable while improving the quality of life in communities. Fundamental to the Smart Growth concept are the following defining principles:

- Preserving and restoring critical environmental areas and the functions and services that these areas provide
- Strengthening and directing development toward existing communities
- Fostering attractive communities with a strong sense of place
- Reintegrating compatible uses in neighborhoods (mixed land use)
- Taking advantage of compact building design
- Creating walkable neighborhoods
- Providing a variety of transportation choices

When applying the concept of Smart Growth, local governments analyze the landscape using the best resource information available about the geographic area, identify the needs and desires of the citizens in visioning their community's future, and then evaluate different scenarios to accommodate future growth in a sustainable manner.

Landscape analysis is an important element of Smart Growth planning. However, it is only in recent years, since the advancement of the Geographic Information System (GIS), that conducting landscape analysis has been possible. Even more recent has been the development of methods to analyze landscape data which provide a scientific understanding of the sensitivities and stressors on natural resources and landscape processes. With this science-based knowledge, local governments and communities can, for the first time, improve their decisions about land uses and more effectively incorporate Smart Growth concepts into land management.

The concept of Smart Growth and its guiding principles can be applied through a variety of mechanisms. Land-use policies using Smart Growth principles encourage mixed-use zoning, limited outward expansion, higher density development, reduced travel, revitalization of urban centers, and preservation and restoration of open space essential to maintaining critical areas and landscape processes. Examples of planning tools using Smart Growth principles include Green Infrastructure planning and Alternative Futures analysis. Both are discussed later in this chapter.

Regulatory practices applying the Smart Growth concept focus on reduction of impervious surfaces, maintenance of tree and vegetative cover, compact building design, etc. Low impact development (LID), traditionally applied as a technical approach to reducing stormwater impacts from developed lands, conceptually falls within the parameters of Smart Growth principles as well. Non-regulatory programs adopted using Smart Growth approaches emphasize preserving and restoring core greenspace areas. Preserving and restoring these areas is most effective when non-regulatory and regulatory tools are both applied.

Smart Growth planning offers the opportunity to take a proactive and resource-based approach to minimizing cumulative impacts on the landscape while maximizing environmental processes that benefit the community. At its best, Smart Growth has the potential to help direct future growth in ways that maintain or improve landscape processes and promote a healthy, functioning environment.

Washington's GMA incorporates some Smart Growth considerations in the directives for the use of critical areas ordinances, concentrating urban development and infrastructure, and conserving resource lands for long-term use. Many of the other Smart Growth elements that are planning and implementation tools can certainly be applied within the GMA context to bring the best land management practices to Washington.

6.4.1 Smart Growth Can Be Used to Develop or Update Local Plans

Smart Growth concepts and associated planning approaches can be applied at any time in the local planning process. (See Sections 6.4.2, 6.4.3, and 6.4.4 for a discussion of planning approaches which use Smart Growth concepts.) It is optimal to incorporate landscape analysis and Smart Growth concepts early in the process whenever a local jurisdiction intends to update its comprehensive plan and implementing ordinances, develop new subarea plans, or expand urban growth areas.

Updates to comprehensive and subarea plans are particularly important times for re-assessing the conditions of local landscapes and evaluating different development options for minimizing future impacts on ecosystems and landscape processes. Smart Growth approaches are more likely to succeed when they are discussed, developed, and implemented as part of a formal planning process. *Watershed academies* or *councils* (committees of scientifically informed citizens) can help guide the planning process. They can make recommendations on how to incorporate information about the landscape and principles of Smart Growth into land-use planning.

In areas close to urban centers that are not yet developed, into which urban growth boundaries may be extended, there is still an opportunity to tailor management needs within the landscape context. In more rural areas, harmful losses can be prevented by re-directing development to the least sensitive locations. These opportunities may well reflect the "best case" scenarios for balancing community needs while maximizing resource protection prior to development, thus sustaining landscape processes and natural resources to avoid expensive land-use problems in the future.

Smart Growth, and other planning processes that incorporate landscape analysis, can help define and identify specific restoration, preservation, and conservation needs and develop plans to address those needs. While it is unrealistic to think that an already built environment will be "un-built," mitigating or compensating actions (e.g., using restoration and preservation) might be identified and take place elsewhere in the vicinity to recover lost functions deemed beneficial by communities and resource managers. In this respect, some of the approaches described in this chapter, and elsewhere in Volume 2, can help identify and address restoration, preservation, and conservation needs in terms of landscape processes and target the type of implementing action needed for each site. (See Chapter 9 for more discussion of non-regulatory tools.)

A case study of the benefits of Smart Growth

A recent study by Preuss and Vemuri (2004) projected the effectiveness of Smart Growth practices implemented in Montgomery County, Maryland, in the 1960s. At that time Montgomery County implemented tools incorporating Smart Growth principles including transfer of development rights, cluster development, and open space acquisition through their land-use plans.

Preuss and Vemuri applied a dynamic model to predict the implications of using Smart Growth tools in Montgomery County during the last four decades. They did so by reviewing three different scenarios: 1) traditional policies, 2) current Smart Growth, and 3) full development. They found that Montgomery's current Smart Growth practices reduced negative effects on water quality and preserved more open space than the other two scenarios. In addition, under Montgomery's existing Smart Growth practices, developable land would still remain into 2050 while being non-existent under the other scenarios.

6.4.2 Planning Approaches Using Smart Growth

To illustrate the application of Smart Growth principles to planning, two approaches are discussed in the following sections: Green Infrastructure (Section 6.4.3) and Alternative Futures (Section 6.4.4). Both of these very similar, yet complementary, approaches examine how the services and infrastructure provided by natural resources can be used to benefit communities while maintaining those resources into the future. These planning approaches can readily be used by local governments to help develop comprehensive plan elements and help guide implementation of regulatory and non-regulatory programs. Comprehensive plans are discussed in Chapter 7.

By developing plans using Green Infrastructure or Alternative Futures, a local jurisdiction can develop the best *greenprint* or preferred alternative for the future. (See Section 6.4.3.1 for a discussion of the approach to developing a Green Infrastructure plan.) The conceptual land-use plan, often presented in the form of a map or maps, includes the location and type of all essential (core) areas that need conservation, preservation, and/or restoration (including degraded areas that provide opportunities to restore processes and functions).

These approaches can include both an assessment of the current and projected needs for infrastructure (e.g., transportation corridors and water and sewage treatment options) as well as the desired land-use patterns that will maintain and protect important environmental processes and functions. The implementation tools used to conserve, preserve, and restore the identified areas may be either regulatory or non-regulatory. Which protection measures work best at any location are determined by the functional attributes of the landscape, the overall risk associated with loss of the resources identified, and, ultimately, the community's vision of the landscape for the future.

See Chapter 8 for a description of restoration and preservation used in a regulatory context and Chapter 9 for restoration, preservation and conservation used in relation to non-regulatory activities. These terms are also defined in the glossary.

6.4.3 Green Infrastructure Planning

Green Infrastructure or *GRIST* is defined as an interconnected network of protected land and water that includes a wide variety of both relatively undisturbed and restored ecosystems and landscape features that make up a system of hubs and links. The network supports native habitat and communities, maintains landscape processes, sustains air and water resources, and contributes to the physical and economic health and quality of life of communities. In addition, this network of lands provides corridors for wildlife movement. (See Section 6.4.3.3 for conceptual illustrations of "hubs and links" and a simplified overview of the typical steps in developing and implementing a GRIST plan.)

The resulting network of ecologically important lands integrates:

- Waterways, wetlands, forests, wildlife habitats, and other such features
- Greenways, parks, and recreation lands
- Working farms, ranches, and forests
- Wilderness and other open spaces that support native species and maintain landscape processes

GRIST plans are an important element of Smart Growth because they help local planners identify and prioritize resources to be preserved, ensure the economic viability of working landscapes, and guide development in a manner that is compatible with sustaining landscape processes and the character of the community. GRIST plans provide a greenprint for accommodating land-use patterns while preserving critical areas, ecosystems, resources, and areas with native species and cultural assets. By integrating the benefits of landscape processes and services, GRIST plans assess current conditions and guide future land uses similar to how a transportation plan provides a blueprint for existing and future travel needs.

The President's Council on Sustainable Development identified Green Infrastructure as a key strategy for achieving sustainability in the report *Towards a Sustainable America – Advancing Prosperity, Opportunity and a Healthy Environment for the 21st Century* (Williamson 2003). Additional references on Green Infrastructure and Smart Growth topics are provided in Appendix 6-A.

6.4.3.1 The GRIST Approach

When developing a GRIST plan (or greenprint), conservation of landscape processes and critical areas establishes the foundation on which the rest of the local comprehensive plan is built.

Integrating the results of landscape analysis (as described in Chapter 5) into the GRIST plan ensures that the functions and processes necessary to maintain long-term protection of natural resources including wetlands are thoroughly understood and considered in avoiding future impacts or loss. For example, areas where significant groundwater discharge/recharge and storage occur would not be appropriate to zone for uses that would result in a high percent of impervious surfaces (e.g., roofs, driveways, roadways, and parking lots). These areas would be more appropriately zoned as open space or other low-density uses, rather than being designated for high-density development. The local jurisdiction might want to consider preserving such areas from development altogether so that the community's water supply is assured into the future.

A GRIST plan can also identify areas that provide important landscape processes that need restoration. For example, this might include areas where construction of levees has separated rivers from their floodplains or where drainage channels are conveying subsurface waters away from wetlands.

Thus, integrating the results of landscape analysis allows a jurisdiction to direct human activities to locations that avoid or minimize impacts to critical areas and other natural resources, sustaining them over time while supporting the community's needs for adequate water supplies, water quality, flood attenuation, etc. In addition, GRIST planning tracks the pace and location of land use in relationship to these outcomes.

GRIST plans are not open space plans

Traditional Open Space Plans (OSP) have been used by jurisdictions throughout Washington for years. These plans are usually developed by the local parks and recreation departments with the intent of securing open spaces which can provide the citizenry with recreation opportunities and/or scenic amenities.

GRIST plans, or greenprints, take the OSP concept further by also examining the functions provided by undeveloped lands and assuring continuity and connectivity between protected features. As the name implies, GRIST plans are designed to protect the “green infrastructure” on the landscape that provides for such “free” functions as flood attenuation, groundwater recharge, water quality filtration, etc. These functions, if lost, would need to be replaced by “engineered infrastructure,” if they can be replaced at all. Additionally, conservation of habitat and biodiversity are also critical aspects of greenprints which are addressed by maintaining core areas with linkages (hubs and links) on the landscape.

Greenprints can be viewed as vital components for achieving both a healthy environment and sustainable communities. As such, they are the building blocks for implementing regulatory and non-regulatory programs. Thus, greenprints represent a community commitment to avoid costly environmental problems through proactive measures. For example, funds traditionally used for engineered infrastructure can be committed to implementing the plan when the functions of “green infrastructure” replace the need for built solutions.

Note: Some local greenprints still primarily focus on recreational lands only. These plans do not incorporate all of the broader principles of GRIST planning. Therefore, any reference to GRIST plans or greenprints in this document is referring to the broader description provided here and not plans that focus strictly on recreation.

GRIST Works in Both Undeveloped and Developed Areas

Communities at any stage of planning or development can incorporate Green Infrastructure into their planning processes:

- **GRIST planning for areas with little urban development.** When applying the results of a landscape analysis through a GRIST plan for a jurisdiction (or portion thereof) that has experienced little human development, a network of critical areas and resource lands can be identified for conservation. This network can be coordinated with plans for the built infrastructure such as essential transportation corridors. Essential “green infrastructure” can be preserved and/or restored while transportation corridors and built environments are accommodated. This clearly identifies where both public and private development will be better suited, thereby allowing land uses that are compatible with maintaining the integrity of the landscape and its processes.

- **GRIST planning for areas that are largely developed.** In jurisdictions where the landscapes have already been largely developed, applying the results of a landscape analysis through a GRIST plan can designate and protect remaining natural resources and critical linkages while still considering the existing roads, urban centers, etc. Here the results of a landscape analysis may provide its greatest benefit by identifying those portions of the landscape where essential processes and functions can and need to be restored to fill in the gaps where functions are needed.

6.4.3.2 Implementing a GRIST Plan

Implementing GRIST planning begins with incorporating the GRIST plan into the Land Use Element of the comprehensive plan (as well as the Shoreline Master Program). Other relevant elements of comprehensive plans should include policies and directives for successfully implementing the GRIST plan. In line with these policies and directives, regulatory and non-regulatory programs and tools should also be updated or developed.

The specific programs and tools to be used for implementation, and where and how they are applied, will depend on the goals and needs of the GRIST plan in relation to landscape processes, their level of degradation, their sensitivity to disturbance, and development pressures. For example, in a particular sub-basin it might be most critical to protect and maintain wetlands because the quality of the water is threatened by non-point pollution. Thus, policies for that basin may direct agricultural landowners to provide stronger buffer protections around aquatic resources. They may also encourage active restoration of aquatic habitats and their buffers, while zoning designations could reflect more stringent wetland standards to protect their ability to improve water quality. In an undeveloped area that provides aquifer recharge, policies and regulations may recommend low-impact development practices or even land acquisition as the preferred tool for protection.

6.4.3.3 Typical Steps for a GRIST Plan

While each local jurisdiction might need to develop a GRIST plan in its own way, there are some key steps that each should address (discussed below). Some of these steps may overlap with the landscape analysis discussed in Chapter 5. For detailed guidance on GRIST planning, please refer to the four-volume workbook titled *Local Greenprinting for Growth* (Trust for Public Lands and National Association of County Officials 2002).

Step 1- Develop the Overall Approach and Define the Geographic Scope

Developing a GRIST plan requires 1) defining the scope of the project, 2) establishing a means of engaging the community through education and public input and providing a forum for group decisions on the plan, and 3) understanding fiscal costs and benefits.

Decisions will be needed regarding the geographic scope of the GRIST plan and the resources that will be examined. The geographic scope is the portion of the landscape under consideration: Is it at the scale of the contributing landscape involving several jurisdictions, or is it a management area such as a county, city, or sub-basin? Defining what areas should be part of a greenprint should ideally be examined in light of the sensitivity of different areas identified during the landscape analysis.

The community must be informed and engaged early in the process because GRIST planning is a process of community visioning and decision-making. Public understanding and involvement are essential to the success of the greenprint design. A communication plan should be created early in the process, identifying how the local citizens will be engaged, what committees will be used to make planning decisions, what will be their composition and decision-making power, etc.

It is advantageous to clearly articulate the fiscal savings that accrue as a result of GRIST planning from the start, both to the citizenry and government decision-makers. Some local jurisdictions conduct fiscal analyses comparing the cost of building infrastructure to the cost of protecting green infrastructure, including the tax savings that green infrastructure can provide to communities. Other fiscal benefits worth considering are those that result from attractive landscapes (e.g., parks and recreation lands, greenbelts, working farms, etc.). These greenspaces are increasingly important in attracting the creative workforce that can add to the economic growth of communities (Florida 2002). As mentioned previously, this is important information since the fiscal value of open space should be communicated to policy-makers as well as the community. (See Section 6.5 of this chapter for further discussion of fiscal benefits.)

Step 2 - Inventory Resources

Conducting an inventory of resources might consist of a landscape analysis as discussed in Chapter 5 or another method that is appropriate to assess the characteristics of the green infrastructure in the planning area. As discussed earlier in this chapter, using a landscape analysis ensures an understanding of the relationship of landscape processes and wetland functions (as well as other natural resources) and how they have been altered. Landscape data can be used in conjunction with information such as detailed ownership patterns and current or projected zoning overlays. Together, this information can assist with deciding how landscape processes and the functions provided by natural resources should be protected, as well as the type and location of preservation and restoration measures needed.

Figure 6-2 provides a simple, conceptual illustration of a landscape that has been inventoried as part of developing a GRIST plan. This graphic serves as the base for Figures 6-3 and 6-4 which illustrate subsequent steps in GRIST planning.

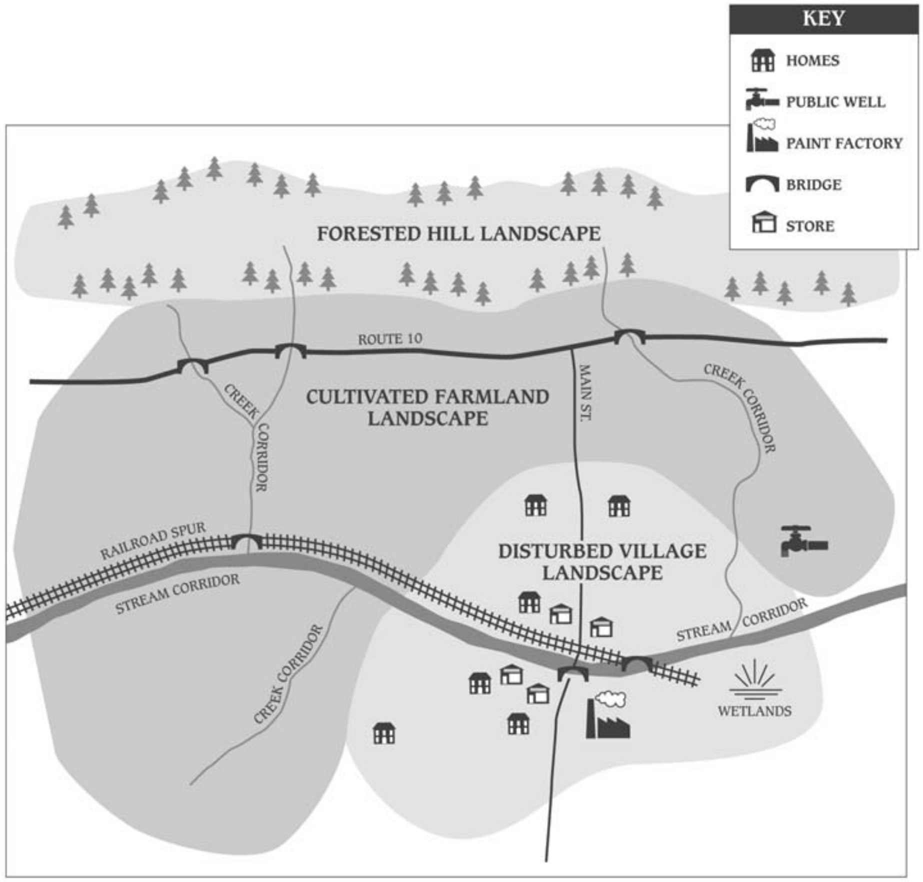

Figure 6-2. Conceptual representation of a landscape that has been inventoried as part of creating a GRIST plan (Figure provided by Heritage Conservancy, a non-profit land trust based in Doylestown, PA).

Step 3 - Envision the Future

Envisioning the future is when the community establishes overriding principles that guide the development of the GRIST plan. These are the goals for the greenprint and may include preserving critical areas and natural resources within each landscape type, maintaining and/or restoring landscape processes, providing or enhancing open space corridors, and so on. The visioning process also inherently should include discussion and identification of the least sensitive lands that are most appropriate for development for a range of uses that are prioritized by the community.

Step 4 - Finding the Hubs and Links

Finding the hubs and links requires a detailed examination of key ownership and land use patterns and defining how they will be addressed in the GRIST plan. Applying a landscape analysis helps to target those areas needing special protection because of their sensitivity or importance. From the landscape analysis, identification of existing or potential hubs and links will become more readily apparent. For example, cultivated lands, areas covered by forest, and existing preserves will be obvious "hub" points from which to consider retaining or recreating "links" between the "hub" sites (see conceptual illustration in Figure 6-3). As this network is envisioned, steps needed to round out as well as implement the plan (e.g., purchasing parcels of land to connect habitat areas or restoring wetlands or riparian areas) become apparent.

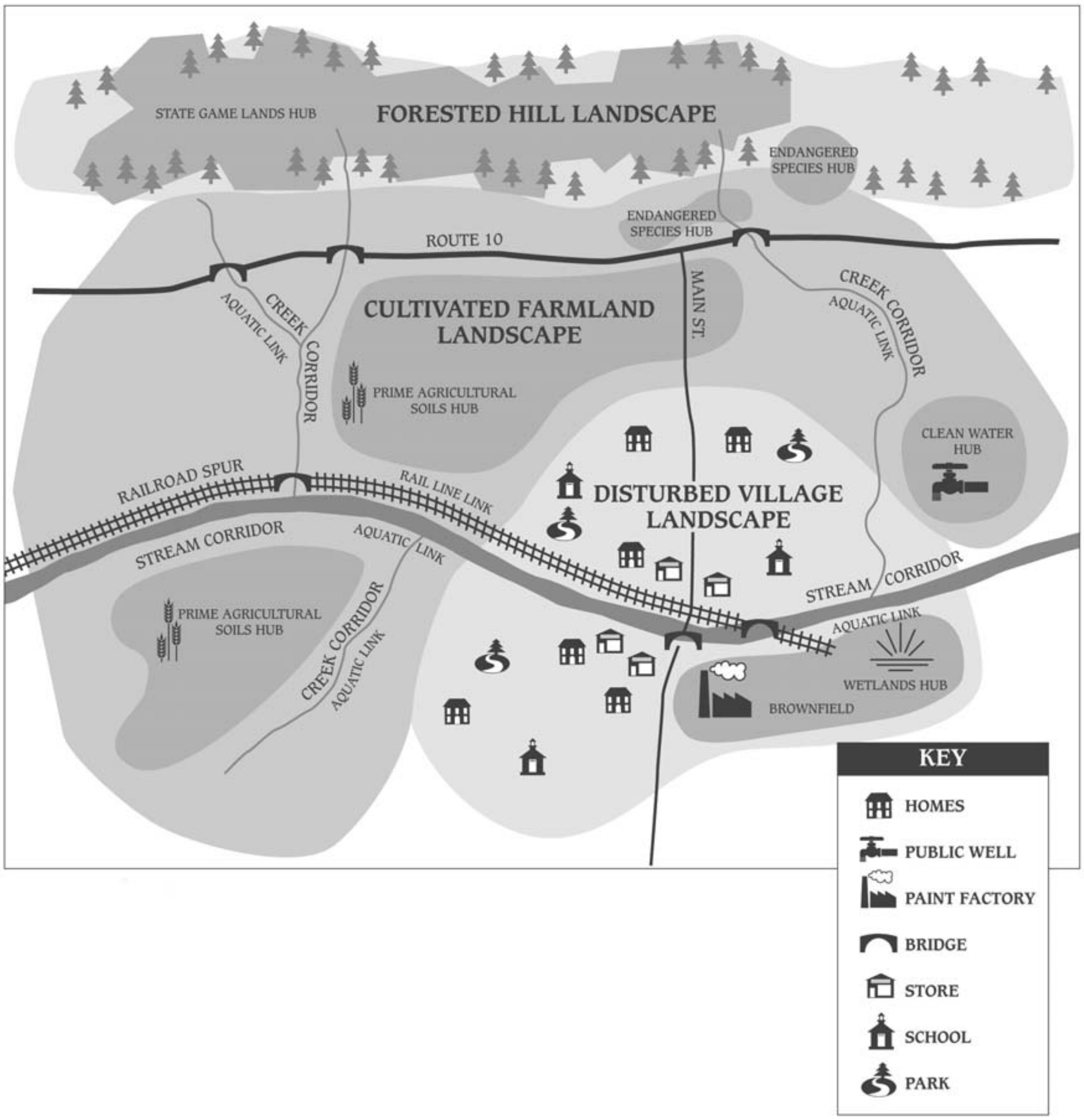

Figure 6-3. Conceptual representation of how hubs and links are identified as part of creating a GRIST plan (Figure provided by Heritage Conservancy, a non-profit land trust based in Doylestown, PA).

Step 5 - Creating the GRIST Plan

Creating the GRIST plan involves identifying potential land-use scenarios based on the information described in the previous steps. Alternative scenarios can be examined using maps to apply different policy and zoning options. The community's goals for the future are applied to these options, and the appropriate course of action can be identified.

This stage in GRIST planning focuses on what specific provisions should be applied in various portions of the landscape to effectively conserve, preserve, and/or restore core areas of concern. At this stage of the process, the need to develop or revise the comprehensive plan, implementing policies and regulations, and non-regulatory tools should be apparent. Figure 6-4 provides a conceptual illustration of a completed GRIST plan.

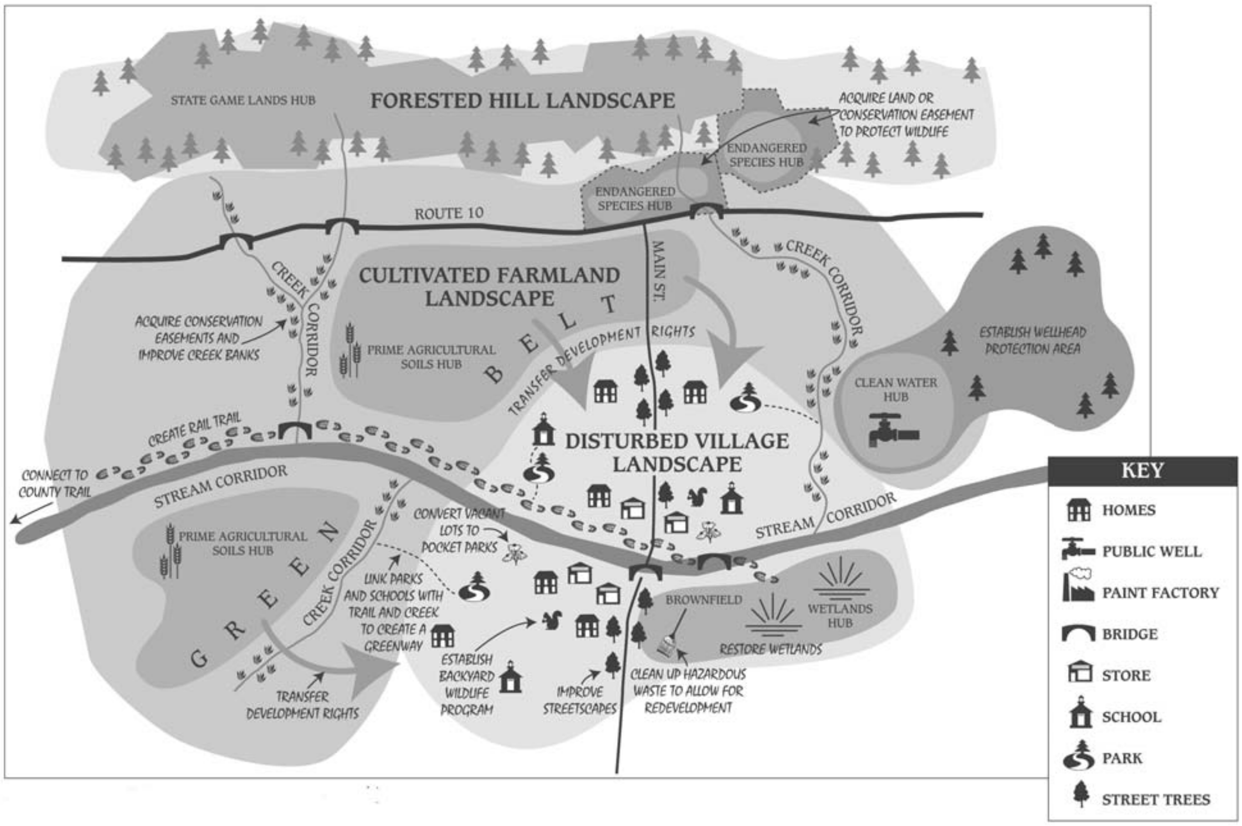

Figure 6-4. Conceptual representation of a completed GRIST plan (Figure provided by Heritage Conservancy, a non-profit land trust based in Doylestown, PA).

Step 6 - Implementing the GRIST Plan

Several means can be used to implement a GRIST plan, beginning with revisions to the Land Use Element of the comprehensive plan. From there, zoning designations and critical areas ordinances or other regulations can be modified as needed. In addition, non-regulatory programs can be established which contain a mix of landowner incentives, acquisition funding, and restoration components. The GRIST plan should be applied throughout the planning area as new zoning decisions and new regulatory protections are developed in proposed urban growth areas, master-planned communities, etc.

6.4.4 Alternative Futures

Alternative Futures is another approach to land-use planning that uses Smart Growth principles. It is similar to Green Infrastructure planning; however, the analysis phase is especially well developed to scientifically quantify the impacts to ecosystems from different, future development scenarios. (See Section 6.4.4.1 on determining the scope of the analysis for more discussion on the topic.)

Alternative Futures offers an excellent example of how a scientific examination of the landscape, when combined with community involvement, leads to a more informed planning process that results in improved environmental conditions and community vitality. As with Green Infrastructure, the community helps to make the informed decisions about land use when evaluating the different scenarios for future development.

A landscape analysis is used to create a series of scientifically supported scenarios that depict what the landscape might look like and how it will perform under different future land-use options. Each scenario is analyzed in regard to the environmental concerns and community priorities that have been identified, similar to those already discussed in the sections on Smart Growth and Green Infrastructure. The analysis uses metric measures (discussed later in this section) to play out the future depictions of development, allowing communities to better assess and evaluate the potential benefits and impacts of each scenario on the environment and community's quality of life.

As with Green Infrastructure, Alternative Futures relies heavily on involving an interested and informed citizenry in the planning and design of a desired future. A strong emphasis is placed on early communication, education, and participation. Community meetings are held to provide the public with maps showing examples of how the landscape will look under the different scenarios. Maps are used to compare different scenarios which reflect various policy and regulatory choices (ranging from more to less stringent protections). The sensitivity of the landscape to disturbances that would result from each scenario is evaluated carefully. Visually comparing the impacts of these scenarios provides an exceptional tool for helping the public to better understand what is at stake and thus make more informed land-use choices about their community's future.

When the preferred option is selected, the result is likely to be a land-use plan based on both protection of the environment and the identified needs of the community. As with Green Infrastructure planning, it is most likely to be both fiscally and environmentally sustainable. It represents the most informed choice, therefore, making it a "smarter growth" alternative.

6.4.4.1 Determining the Scope of the Analysis

The analysis, which is the hallmark of Alternative Futures, involves a broad, logic-driven process that incorporates the specific needs of a local community while evaluating land-use scenarios for their ability to retain long-term environmental and economic vitality. It begins with assessing the current condition of the landscape and land uses.

The community, with the technical assistance of supporting agencies, develops the scope of the analysis: size of the planning unit to be analyzed, scale of the effort, functions and issues that are of interest, the approach, method, and metrics used in the analysis, and the capabilities of the local government.

Size of the Planning Unit

The size of the landscape planning unit to be analyzed may be as large as a regional, terrestrial ecosystem (such as the Puget Lowlands), a large drainage basin (like the Snohomish River) or as small as a local sub-basin. The unit may cross several political boundaries or only encompass a limited portion of one jurisdiction. It may cover many miles and acres or only a few.

Scale of the Effort

The scale of the effort refers to whether the analysis will be designed to provide information for broader strategies and visions or for a more focused effort. This decision affects the type of scientific method(s) chosen and the level of detail that will be used to conduct the analysis. Generally, the analysis for broader strategies or visions involves larger geographic areas, and less detailed (more general) methods are appropriate. By contrast, a more focused planning effort might involve a sub-basin, for example, and require methods that result in more detailed information that is focused on spatially explicit, management options and recommendations. With this information, specific on-the-ground actions, or consequences, can be clearly evaluated.

Functions and Issues of Interest

Analyzing the landscape is the best approach to understand landscape processes and ecosystem functions at work across the planning unit and to examine ecological issues of concern. Therefore, the analysis may need to broadly cover a suite of functions and/or issues, or it may need to focus on specific areas of greatest concern. The community may decide the analysis should focus on current problems or problems that may result from future land uses. For example, the community may select flooding, water quality, habitat and biodiversity, or groundwater recharge as the issues/functions they believe should be examined in the analysis.

Approach, Method, and Metrics

Selecting the approach for conducting the Alternative Futures analysis will follow the previous decisions. Approaches that are “geospatial” must be compatible with the size of the planning unit, the scope of the process, and the scale of the effort. Geospatial refers to the geographic location and characteristics of natural or constructed features and boundaries on the Earth. Generally, geospatial approaches are used to simulate the effects of land-use change on landscape processes and ecosystems.

There are two geospatial approaches that can be used in an Alternative Futures analysis depending on the local community's particular needs:

- **Forecasting**. The common approach is to apply models that evaluate the impacts and environmental outcomes expected under several different development scenarios. Here each policy option is simulated in the model to predict the appearance and environmental performance of the future landscape, resulting from that policy choice.

- **Backcasting.** Alternatively, a concept called "backcasting" can be applied to develop future scenarios aimed at achieving certain desired end-points (Robertson 2003). In this approach, the future landscape condition is selected first. Then analysis and modeling are focused on effectively finding development policies that will successfully achieve that pre-chosen outcome. This is a very effective approach for holding the line in places where further degradation will collapse an entire ecosystem, leaving the community's economic vitality in crisis.

Method for Analyzing the Landscape

Before selecting the approach to use for an Alternative Futures analysis, a good starting point, as previously mentioned, is analyzing the landscape. Appendix 5-B lists some methods that can be used to analyze the landscape and one of the methods is being developed by the Department of Ecology (www.ecy.wa.gov/programs/sea/landscape). It provides a geomorphic examination of landscape processes in a defined area using a Geographic Information System (GIS). It is designed to be used in planning and can provide information at more than one geographic scale. For example, it can be used for larger planning units to provide a broad understanding of the processes at work in the landscape and to identify regional issues of concern such as water quality problems. It can also be used within smaller areas of interest or concern to conduct more refined analyses.

Products of Ecology's method for landscape analysis include characterizations of past, current, and potential environmental conditions. The analysis can identify problem areas that are of concern and relate them to the existing landscape processes and the ecological functions in the area. Examples include beaches with shellfish beds that have been closed, areas with poor water quality, habitat areas that need to be restored, etc. The analysis can be used to develop proactive strategies to avoid future impacts of development.

Assessment Metrics

Along with the landscape analysis method, equally important in the Alternative Futures analysis is the use of appropriate assessment metrics or measures: environmental indicators of condition, stress, or response within an ecosystem that can be used in a predictive manner. Metrics are usually selected based on a significant statistical correlation with scientific data linking environmental stresses to a predictable environmental response (e.g., a correlation between impervious surface and the condition of aquatic habitats). Assessment metrics are often calibrated to better reflect local conditions within the specific area in which they will be applied. Several metrics are typically used in order to ensure the reliability of the analysis. The selection and use of such assessment metrics is an important and key component of evaluating alternative land-use scenarios.

Current research in the Pacific Northwest, and Puget Sound specifically, is building our understanding of some of the key stresses that affect landscape processes throughout the region and within particular local areas. Local researchers (e.g., Alberti et al. 2003), using geospatial techniques, are investigating and developing various assessment metrics essential to retaining watershed condition such as amounts of impervious surfaces, road density, number of stream crossings, and riparian and floodplain connectivity. These measures are being offered to practitioners for pilot testing and application.

When using these metrics, communities can expect to identify, for example, what percentage of cover from relatively undisturbed vegetation is needed to prevent problems within watersheds. Another example is what percentage of connectivity between habitats will assure that existing habitats remain viable. This information is directly used in the comparison of different land-use scenarios, for choosing the preferred alternative, and for implementation of the preventative or corrective actions that follow.

Local Government Capacity

It is important to recognize that the scientific rigor of the analysis and the success of the planning process may be dependent on a number of local factors such as:

- Type, extent, and reliability of natural resource data currently available in the landscape planning area
- Skills of existing staff in regard to conducting an Alternative Futures analysis, especially GIS applications
- Adequate funding to employ the assistance of consultants if needed
- Time needed to complete the steps of the analysis and planning process
- Ability to engage the public and coordinate the effort

Given all these factors, how an Alternative Futures process is conducted (both analysis and planning) will vary widely between jurisdictions and planning units. The value of conducting an Alternative Futures analysis, however, remains. It can provide important information such as the longer-term environmental costs and benefits of various development scenarios, thereby pointing out possible solutions and misperceptions. The result may be the achievement of multiple goals: protecting valued natural resources, maintaining or improving community quality of life, retaining economic vitality, and saving tax dollars. (See Section 6.5 for a discussion of fiscal benefits.)

6.4.4.2 Local Example of Alternative Futures Planning

In January 2001, the Kitsap County Department of Natural Resources used the Alternative Futures process to examine different scenarios in the Chico Creek watershed. The Chico Creek watershed drains 16.3 square miles of land west of Dyes Inlet in Kitsap County. Their goal was to develop an amendment to the County's comprehensive plan for this subarea. Locally referred to as "Planning by Watershed," the pilot Alternative Futures project was funded by the U.S. Environmental Protection Agency under a grant to the Puget Sound Action Team. Information regarding the details of the project can be found at: www.psat.wa.gov/Programs/growth/LID_futures.htm.

The County found the Alternative Futures approach was a unifying process that resulted in the integration of land-use planning with other regional efforts such as watershed planning, salmon recovery, clean water plans, as well as regulatory directives in the Growth Management Act. Using the Alternative Futures process, the county developed their preferred development scenario by:

- Conducting a technical analysis of current conditions in the watershed
- Involving citizens and interested parties in developing and selecting scenarios
- Testing the scenarios using Geographic Information System and scientific analyses
- Making an informed selection of the preferred scenario for future land use

To accomplish these tasks, they established goals for analysis of the watershed, analysis of the scenarios, and the planning process.

A strong component of Kitsap County's approach was public involvement. Five subcommittees were established, including an education work group, a public involvement work group, a technical work group, a restoration work group, and a watershed advisory committee. From these they constructed an effective education campaign and public involvement process.

Four scenarios were examined: 1) the "current regulatory" condition, 2) a "strong development" scenario, 3) a "strong conservation" scenario, and 4) a "moderate" scenario falling between development and conservation. A suite of analyses, using natural resource indicators, was conducted to identify the impacts of each alternative. The strong development scenario was quickly dropped due to the severity of impacts. The current regulatory condition then became the option with the greatest amount of development. In the end, the community selected the moderate development scenario which incorporated conservation-based patterns and practices.

Kitsap County officials were pleased with the benefits of the Chico Creek project and propose using the Alternative Futures process to develop subarea plans for other watersheds throughout the county.

6.4.5 Combining Complimentary Approaches

Landscape analysis, Green Infrastructure, and Alternative Futures are all complementary approaches. Applying the core elements of these three approaches in combination can offer a strong analytical package for making land-use decisions that will benefit communities while considering landscape processes.

Information about the landscape is an essential component of Green Infrastructure and especially Alternative Futures, as described in the preceding sections. In brief, it can be used as a tool to integrate information about different resources into the planning process in order to identify the issues of highest priority and develop alternative land-use scenarios. These scenarios can be analyzed (using GIS) and visually displayed as maps. Ecology's method for landscape analysis (www.ecy.wa.gov/programs/sea/landscape) can be used from a larger scale of analysis down to a smaller scale, thus assessing across scales and focusing in on key issues. Therefore, landscape analysis together with GRIST or Alternative Futures can provide a very useful complement for visually displaying and analyzing the effects of land-use decisions on the maintenance of landscape processes.

Adding the concepts of GRIST planning to Alternative Futures can:

- Reinforce the benefit of using landscape analysis as the basis for planning so that landscape processes can be sustained
- Emphasize the role of landscape processes and the functions of ecosystems such as wetlands as "infrastructure" and therefore worthy of protection for fiscal reasons
- Add hubs and links as corridors important to the maintenance of landscape processes
- Integrate working landscapes (such as agricultural and forest lands) as valued green space into land-use plans

The results of Alternative Futures may be more successfully implemented if combined with GRIST planning because it focuses on implementation using conservation measures and thus it can immediately advance conservation decisions which result from the Alternative Futures process.

Likewise, Alternative Futures compliments GRIST planning by:

- Applying metrics to quantify the impacts of disturbance on the landscape and to evaluate options
- Targeting sensitive features and critical functions which are important to include in a greenprint

6.5 Fiscal Savings and Other Benefits

Protection of landscape processes and the functions of ecosystems, such as wetlands and other critical areas, can provide important fiscal savings as well as other benefits. Many people assume that revenue will be lost as a result of land protection, while the costs of constructing infrastructure, to provide necessary services once green space is gone and landscape processes are degraded, are often overlooked.

Several recent papers have documented the costs associated with losing ecosystems that provide landscape processes and wetland functions. In *Taking its Toll: The Hidden Costs of Sprawl in Washington State*, Mazza and Fodor (2000) point to water quality and quantity impacts, smog and health issues, habitat and species losses, overall watershed decline, and general quality of life concerns. All of these losses can affect the economic viability of communities.

A report by the Trust for Public Land and The National Association of County Officials (2002) presents the numerous benefits of recognizing certain lands as necessities, not just amenities. The benefits include:

- Fiscal savings, which result when the benefits gained from preserving open space exceed the cost
- Economic benefits, when improved quality of life attracts business investment
- Free infrastructure, when green space provides services that avoid the expense of building infrastructure to replace functions, thus saving tax-payers' money
- Environmental benefits, when land-use planning is linked to the protection of landscape processes
- Health and social amenities, when, for example, recreation opportunities deter antisocial behavior by providing constructive activities, thereby contributing to the health and wellness of communities

The following paragraphs discuss and provide examples of three general types of fiscal savings resulting from protection of landscape processes through the planning processes described in this chapter.

6.5.1 Using Green Infrastructure Instead of Constructing Infrastructure

As demonstrated in the examples that follow, communities around the country that conduct a fiscal analysis of their revenues versus expenditures are finding that conservation of green infrastructure saves money in the long term. Purchasing and preserving land results in cost savings by avoiding the need to build infrastructure such as systems for controlling flood water when landscape processes and the functions of ecosytems are lost.

When New York City was faced with the need to spend $8 billion on new water filtration and treatment plants, they instead purchased 80,000 acres of land in the Catskill Mountains for $1.5 billion. The land functions to filter and purify drinking water. Purchasing the land (which is located in the watershed for the city) saved the city $6.5 billion by not building treatment plants and another $300 million a year in forgone costs of operating them.

In the Charles River Basin in Massachusetts, 8,500 acres of wetlands were acquired and preserved to provide storage for floodwater in the valley. The cost for acquisition was $10 million compared to the $100 million cost of an alternative proposal which would have resulted in the construction of dams and levees to accomplish the same goal (Fausold & Lilieholm, 1996).

The value of the tree canopy was illustrated in the Willamette/Lower Columbia region here in the Pacific Northwest. In a 7-million-acre area, the tree canopy has been reduced from 46% to 24% between 1972 and 2000 due to the expansion of roads, buildings, and pavement. This 28-year loss in canopy has resulted in $2.4 billion in costs for managing the increased stormwater runoff, according to a Regional Ecosystem Analysis by American Forests (2001). In addition, each year the lost canopy of trees would have absorbed 138 million pounds of pollutants and saved $322 million in related cleanup costs.

Despite the significant loss in tree canopy, the remaining forest continues to provide functions related to stormwater and water quality. According to the study, the region's remaining trees are still detaining and purifying a massive quantity of stormwater that would have otherwise required construction of a $20.2 billion treatment plant to manage runoff. The trees also absorb 178 million pounds of pollutants on an annual basis, whose potential cleanup would cost $419 million a year.

6.5.2 Increase in the Local Tax Base

Protecting areas that provide landscape processes can increase the tax base by attracting home buyers to properties near green spaces such as wetlands, thereby improving the homeowner's quality of life. This is called "enhancement value," the tendency of open space to enhance the property value of adjacent properties

Quality of life is a determining factor in real estate values and economic vitality. The green spaces of Portland, Oregon, for example, have helped build this city's reputation as one of the country's "most livable cities." A study in Portland found that residential property values increased, $436 for every $1000 feet, if they were in closer proximity to a wetland (Barclay et al. 2004). "The real estate market consistently demonstrates that many people are willing to pay a larger amount for property located close to parks and open space areas than for a home that does not offer this amenity," writes John L. Crompton, a professor at Texas A&M University (Sherer 2003).

The higher value of these homes means that their owners are paying higher property taxes, thereby benefiting the community as a whole. In some instances, the additional property taxes are sufficient to pay the annual charges on bonds used to finance the acquisition and development of open spaces. This has been demonstrated in a study examining the proximity of residences to greenbelts in Boulder, Colorado. Here the average values of homes next to the greenbelt were 32% higher than those just 3,200 feet away. The study showed that the greenbelt added $5.4 million to the total property values of one neighborhood, generating $500,000 per year in additional property taxes. This was enough to cover the $1.5 million purchase price of the greenbelt in only 3 years (Sherer 2003).

Home owners can get tax relief to off-set an increase in property values and taxes if conservation easements are involved. Federal income tax law (U.S. Treasury Regulation Sec. 14 (h)(3)(i)) states that valuation of conservation easements is required to take into account the resulting increase in adjacent property value on land owned by the same donor.

The ability to attract business to a community is also affected by the presence of open space and the health of the environment. Barclay et al. (2004) have noted that environmental quality plays a pivotal role in the ability of a region to attract workers and new firms. They state that a community with a degraded environment is more likely to suffer economically.

It is important to note that the value of natural resources is not fixed in time: The values of many of the landscape processes and the functions of natural resources are growing as they become increasingly scarce.

6.5.3 Reducing Costs of Public Services

The cost of providing public services (roads, fire & police protection, etc.) to a community is less in areas with open spaces. A national study by the American Farmland Trust (cited in Mazza and Fodor 2000) showed that for every $1 generated in tax revenue, the median cost to provide services to residential areas was $1.15, while only $0.37 was spent in areas with agricultural or natural resource lands. The Trust conducted a similar study in Skagit County and found that infrastructure costs for residential services were $1.32 for each dollar of tax revenue as compared to $0.32 for farm, forest, and open space lands.

In addition, the tax base generated by new homes does not cover the actual cost of providing the basic services required. A study in Washington showed that the added expense of off-site facilities (such as schools) that would provide services to a typical new home is $20,000 to $30,000, which does not match the tax revenue generated to cover these costs (Mazza and Fodor 2000). Additional information on this topic can be found in a paper on the *Three Myths of Growth* (Fodor 1996), which debunks the belief that growth builds a tax base that provides enough revenues to cover the necessary services.

Developing land using the guidance of a GRIST plan may result in lower property and school taxes. For example, the town of Pittsford, New York, commissioned Behan Planning Associates to apply a fiscal model to determine the costs of expanded urban development versus the costs of land protection. The fiscal model predicted future tax rates based upon the costs and revenues associated with future land-use patterns. The model estimated that, for the average tax payer, property and school taxes would increase only $1400 over 20 years using the "green infrastructure" scenario, in comparison to $5000 if the lands were fully developed under their existing policies. This analysis revealed that it would be much less expensive to implement the greenprint than allow development in the wrong locations (Trust for Public Land and National Association of County Officials 2002).

Additional resources

Many resources are available for local governments that wish to pursue Smart Growth, Green Infrastructure, Alternative Futures, and associated concepts discussed in this chapter. For further information, see the published and online resources listed in Appendix 6-A.